Task Machine Competition
Mechanism Workshop

Brought to you by the SI Lab Advisors!
The 2021 Fall Competition Is... A Task Machine!

- Whaaa? What exactly is a Task Machine?
  - Machine that undoes whatever action it performs.
- Goal:
  - Creativity and Entertainment
  - Simple or complex as you want!
  - Fun challenge
- Example:
  - We made a box with Rhett popping out of it!
- Really cool example
Mechanism Requirements and Goals

- 5 categories the mechanism will be scored on:
  - **Build Quality (10%)**
    - Mechanism has no problems or need for adjustments between runs
  - **Design (20%)**
    - Innovative mechanism for undoing an action
  - **Creativity (20%)**
    - Strive for a wholly unique idea that entertains
    - Takes an existing idea and furthers it
  - **Functionality (20%)**
    - Machine always completes its complex action
  - **Personality (30%)**
    - Machine has lots of actions, (aka has a ‘Personality’ to it!)
## CHALLENGE SUBMISSION SCORE

<table>
<thead>
<tr>
<th># Points</th>
<th>0-3</th>
<th>4-7</th>
<th>8-10</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Build Quality</strong> (10%)</td>
<td>Box is Jerry rigged together, held together by tape, etc</td>
<td>Box holds together fine, but the mechanism has problems, needs help or adjustment</td>
<td>Box and mechanism both work well and have been made well. Obviously a quality piece of work</td>
<td></td>
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<tr>
<td><strong>Design (20%)</strong></td>
<td>Machine is a basic or rudimentary take on a task machine</td>
<td>The machine’s design incorporates either an elegant box/shell or an innovative mechanism for undoing an action</td>
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<tr>
<td><strong>Creativity (20%)</strong></td>
<td>Copies an existing design</td>
<td>Takes an existing design or idea one step further with some improvement (mechanical, quality, or personality)</td>
<td>Wholly unique idea that demonstrates the whole spirit of a task machine (the machine is something that entertains and creates a bit of a sense of wonder)</td>
<td></td>
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<tr>
<td><strong>Functionality (20%)</strong></td>
<td>Machine usually completes its action, but sometimes faults</td>
<td>Machine always completes its action but it is very basic</td>
<td>Machine always completes its complex action</td>
<td></td>
</tr>
<tr>
<td><strong>Personality (30%)</strong></td>
<td>Machine simply does the same thing each time</td>
<td>Machine has a few (2-3) types of action</td>
<td>Machine has a lot of types of action, and seems to have a personality to it</td>
<td><strong>Total Score</strong></td>
</tr>
</tbody>
</table>

*Up on the website*
Basic Arduino Refresher - Hardware

- **Digital Input/Output Pins.** Connect signal pins of sensors, lights, etc. here.

- **Plug in the USB cable here to connect to your computer.**

- **Connect to a 9V battery here if you have an adapter.**

- **Provides 5V power to a circuit.**

- **Either of these will ground the circuit.**

- **Analog pins, for sensors that measure a continuum.**
Basic Servo + Switch Example

- Arduino Uno (USB powered)
  - Output: 5V
- 5V Servo
- Capacitor 100μF 20V
- Switch with 10k Ohm resistor

*Tip! Capacitors help servos run smoothly by smoothing current fluctuations!
Basic Arduino Refresher - Software Example

* Arduino IDE is super beginner-friendly and is written in C++!

* Example Servo + Switch code for mechanism before
Basic Servo + Switch Example

```cpp
#include <Servo.h>

Servo myservo; // create servo object
int pos = 0; // variable to store the baseline servo position
int switchPin = 5;

void setup() {
    myservo.attach(7); // attaches the servo on pin 7 to the servo object
    pinMode(switchPin, INPUT); // sets servo to Pin 5 I/O
    myservo.write(0); // set servo arm to baseline position 0
}

void loop() {
    if(digitalRead(switchPin) == HIGH) // **circuit is closed w/in switch system (signal in pin 5 is read!)
        for (pos = 0; pos <= 180; pos += 1) // goes from 0 -> 180 deg in steps of 1 deg
            { // tell servo to go to position in variable 'pos'
                myservo.write(pos);
                delay(15); // waits 15ms for the servo to reach the position
            }
}
```
Online Resources

- How do I Know What I Need to Know?
  - Spec Sheets (microcontroller, LCD, LEDs, servos, capacitors, etc.)
    - Arduino Uno R3
    - HS-311 Servo
  - Arduino Project Hub
    - [https://www.instructables.com/Auduino-Useless-Box/](https://www.instructables.com/Auduino-Useless-Box/)
  - Arduino Forum
  - Github, Stackoverflow
  - Multimeters are your friends!
  - Finally... $V = IR$
Basic Electronic Skills: Soldering

- SOLDERING IRON
- WIRE CUTTER
- PCB
- PARTS

THE IRON IS HOT!! BE CAREFUL!

YOUR KIT SHOULD COME WITH INSTRUCTIONS FOR WHAT PARTS GO WHERE AND WHAT WAY!

CLEAN THE TIP OF YOUR IRON BEFORE EACH SOLDER CONNECTION!
Mechanism Thought Process -

Idea
Takeaway what mechanism aspects we liked
Brainstormed what we want to add/change

Parts Testing
Tested Servos, LCD, LED strip separately
Drew out circuit schematics + code for each

Combine Parts and Test Placement
Combined code, schematics, and parts. Test final placements and adjust code/schematic if needed

Create Final Parts and Mount
Secure hardware, mount mechanism in final product, create BOM for mechanism, final round testing
Competition Reminders

- Reminder that competition comes with Prize Money!
- 1st - $300
- 2nd - $200
- 3rd - $100
- Each team will be reimbursed up to $50 for outside competition supplies!
  - Includes items that can be returned to the lab for future use, such as:
    - Arduino Nano ~ $10
    - Servo Motors ~ $12 each/$24 total
    - Wires ~ $7
- Work in Teams!
  - If you don’t have one and want one we can find a team for you!
QUESTIONS/COMMENTS?

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